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L5: Entry 1 of 5 File: USPT Aug 26, 2003

DOCUMENT-IDENTIFIER: US 6610392 B1
TITLE: Heat-shrinkable multilayer packaging film comprising inner layer comprising a polyester

Abstract Text (1):
A heat-shrinkable multilayer film comprises (A) a first layer, which is an outer layer, and which comprises polyolefin; (B) a second layer comprising at least one member selected from the group consisting of polyolefin, polystyrene, and polyurethane; (C) a third layer comprising at least one member selected from the group consisting of amorphous polyester and polyester having a melting point of from about 130.degree. C. to about 260.degree. C.; (D) a fourth layer, which is an outer layer, the fourth layer comprising at least one member selected from the group consisting of polyester, polyamide and polyurethane. The first layer preferably serves as a seal layer in a heat-shrinkable bag. The third layer provides enhanced impact strength, optics, grease-resistance, and free-shrink of the film, and renders the tape more easily orientable. The high melting polyester, polyamide, and/or polyurethane of the fourth layer permits at least two bags, having product therein, to be stacked on top of one another and sealed simultaneously, without sticking to one another, thereby doubling the output of a vacuum chamber machine. A bag and a process of making a packaged product are also disclosed.

Brief Summary Text (29):
As a third aspect, the present invention is directed to a process for packaging a product, comprising the steps of: (A) placing a first product into a flexible, heat-shrinkable bag which is in accordance with the second aspect of the present invention; (B) repeating the placing step with a second product and a second bag, whereby a second bagged product results, (C)stacking at least the first and second bagged products so that an excess bag length of each of the bagged products are within a sealing distance of a means for heat-sealing, and (D) heat-sealing the inside layer of first bag to itself in the region between the open end of the first bag and the first product, and the inside layer of the second bag to itself in the region between the open end of the second bag and the second product, so that the first product is completely sealed within the first bag and the second product is completely sealed with the second bag. The sealing is carried out at a temperature so that the resulting packaged products can be freely separated from one another without layer delamination. The bag has an open top so that prior to sealing, both the first bagged product and the second bagged product have excess bag length. During sealing of each bag, the first layer is sealed to itself, as the first layer is the inside layer in both the first bag and the second bag. Likewise, the fourth layer is the outside layer of the first bag and the second bag. The process can be carried out in a continuous, single, dual, or rotary chamber vacuum packaging machine. Preferably, from 2 to 5 bagged products are stacked on top of one another during heat-sealing. Preferably, the process utilizes a preferred bag in accordance with the present invention.

Detailed Description Text (9):
As used herein, the phrases "seal layer", "sealing layer", "heat seal layer", and "sealant layer", refer to an outer layer, or layers, involved in the sealing of the film to itself, another layer of the same or another film, and/or another article which is not a film. Although it should also be recognized that in general, up to the outer 3 mils of a film can be involved in the sealing of the film to itself or another layer, the phrase "seal layer," and the like, refer herein only to the outer

film layer(s) which is to be heat-sealed to itself, another film, etc. Any inner film layers which contribute to the sealing performance of the film are herein designated as "seal-assist" layers. With respect to packages having only fin-type seals, as opposed to lap-type seals, the phrase "sealant layer" generally refers to the inside layer of a package, the inside layer being an outer film layer which frequently also serves as a food contact layer in the packaging of foods. However, in a multilayer film, the composition of the other layers (within 3 mils of the inside surface) can also affect sealability and seal strength.

Detailed Description Text (11):
As used herein, the term "seal" refers to any seal of a first region of a film surface to a second region of a film surface, wherein the seal is formed by heating the regions to at least their respective seal initiation temperatures. The heating can be performed by any one or more of a wide variety of manners, such as using a heated bar, hot wire, hot air, infrared radiation, ultrasonic sealing, etc. Heat-sealing is the process of joining two or more thermoplastic films or sheets by heating areas in contact with each other to the temperature at which fusion occurs, usually aided by pressure. Heat-sealing is inclusive of thermal sealing, melt-bead sealing, impulse sealing, dielectric sealing, and ultrasonic sealing.

Detailed Description Text (54):
As used herein, the term "adhered" is inclusive of films which are directly adhered to one another using a heat-seal or other means, as well as films which are adhered to one another using an adhesive which is between the two films. As used herein, the phrase "directly adhered", as applied to layers, is defined as adhesion of the subject layer to the object layer, without a tie layer, adhesive, or other layer therebetween. In contrast, as used herein, the word "between", as applied to a layer expressed as being between two other specified layers, includes both direct adherence of the subject layer between to the two other layers it is between, as well as including a lack of direct adherence to either or both of the two other layers the subject layer is between, i.e., one or more additional layers can be imposed between the subject layer and one or more of the layers the subject layer is between.

Detailed Description Text (91):
FIG. 1 illustrates a schematic view of a first preferred process for making films according to the present invention. As illustrated in FIG. 1, solid polymer beads (not illustrated) are fed to a plurality of extruders 28 (for simplicity, only one extruder is illustrated). Inside extruders 28, the polymer beads are forwarded, melted, and degassed, following which the resulting bubble-free melt is forwarded into die head 30, and extruded through an annular die, resulting in tubing 32 which is preferably about 10 to 20 mils thick.

Detailed Description Text (92):
After cooling or quenching by water spray from cooling ring 34, tubing 32 is collapsed by pinch rolls 36, and is thereafter fed through irradiation vault 38 surrounded by shielding 40, where tubing 32 is irradiated with high energy electrons (i.e., ionizing radiation) from iron core. transformer accelerator 42. Tubing 32 is guided through irradiation vault 38 on rolls 44. Preferably, tubing 32 is irradiated to a level of from about 40 kGy to about 120kGy.

Detailed Description Text (93):
After irradiation, irradiated tubing 46 is directed through pinch rolls 48, following which irradiated tubing 46 is slightly inflated, resulting in trapped bubble 50. However, at trapped bubble 50, the tubing is not significantly drawn longitudinally, as the surface speed of nip rolls 52 are about the same speed as nip rolls 48. Furthermore, irradiated tubing 46 is inflated only enough to provide a substantially circular tubing without significant transverse orientation, i.e., without stretching.

Detailed Description Text (94):
Slightly inflated, irradiated tubing 46 is passed through vacuum chamber 54, and thereafter forwarded through coating die 56. Annular coating stream 58 is melt extruded from coating die 56 and coated onto slightly inflated, irradiated tube 50, to form two-ply tubular film 60. Coating stream 58 preferably comprises an O.sub.2

-barrier layer, which does not pass through the ionizing radiation. Further details of the above-described coating step are generally as set forth in U.S. Pat. No. 4,278,738, to BRAX et. al., which is hereby incorporated by reference thereto, in its entirety.

Detailed Description Text (95):
After irradiation and coating, two-ply tubing film 60 is wound up onto windup roll 62. Thereafter, windup roll 62 is removed and installed as unwind roll 64, on a second stage in the process of making the tubing film as ultimately desired. Two-ply tubular film 60, from unwind roll 64, is unwound and passed over guide roll 66, after which two-ply tubular film 60 passes into hot water bath tank 68 containing hot water 70. The now collapsed, irradiated, coated tubular film 60 is immersed in hot water 70 (preferably, having temperature of about 185.degree. F. to 210.degree. F.) for a period of from about 10 to about 100 seconds, i.e., for a time period in order to bring the film up to the desired temperature for biaxial orientation.

Detailed Description Text (96):
Thereafter, irradiated tubular film 60 is directed through nip rolls 72, and bubble 74 is blown, thereby transversely stretching tubular film 60. Furthermore, while being blown, i.e., transversely stretched, nip rolls 76 draw tubular film 60 in the longitudinal direction, as nip rolls 76 have a surface speed higher than the surface speed of nip rolls 72. As a result of the transverse stretching and longitudinal drawing, irradiated, coated biaxially-oriented blown tubing film 78 is produced, this blown tubing preferably having been both stretched in a ratio of from about 1:1.5 to about 1:6, and drawn at a ratio of from about 1:1.5 to about 1:6; more preferably, the stretching and drawing are each performed a ratio of from about 1:2 to about 1:4. The result is a biaxial orientation of from about 1:2.25 to about 1:36, more preferably, from about 1:4 to about 1:16. While bubble 74 is maintained between pinch rolls 72 and 76, blown tubing 78 is collapsed by rollers 80, and thereafter conveyed through pinch rolls 76 and across guide roll 82, and then rolled onto wind-up roll 84. Idler roll 86 assures a good wind-up.

Detailed Description Text (97):
FIG. 2 illustrates a schematic of a second preferred process for making a film in accordance with the present invention. In FIG. 2, solid polymer beads (not illustrated) are fed to a plurality of extruders (for simplicity, only extruder 88 is illustrated). Inside extruders 88, the polymer beads are forwarded, melted, and degassed, following which the resulting bubble-free melt is forwarded into die head 90, and extruded through an annular die, resulting in tubing tape 92 which is preferably from about 10 to 20 mils thick, and preferably has a lay-flat width of from about 2 to 10 inches.

Detailed Description Text (98):
After cooling or quenching by water spray from cooling ring 94, tubing tape 92 is collapsed by pinch rolls 96, and is thereafter fed through irradiation vault 98 surrounded by shielding 100, where tubing 92 is irradiated with high energy electrons (i.e., ionizing radiation) from iron core transformer accelerator 102. Tubing 92 is guided through irradiation vault 98 on rolls 104. Preferably, tubing 92 is irradiated to a level of from about 40 to about 120 kGy, resulting in irradiated tubing 106, which is then passed over guide roll 116, after which irradiated tubing 106 is passed into and through hot water bath tank 118 containing hot water 120. Irradiated tubing 106 is immersed in hot water 120 (preferably having a temperature of about 185 to about 210.degree. F.) for a period of about 10 to about 100 seconds, i.e., for a time period long enough to bring the film up to the desired temperature for biaxial orientation. Thereafter, the resulting hot, irradiated tubing 122 is directed through nip rolls 124, and bubble 126 is blown, thereby transversely stretching hot, irradiated tubular tubing 122 so that an oriented film tube 128 is formed. Furthermore, while being blown, i.e., transversely stretched, nip rolls 130 have a surface speed higher than the surface speed of nip rolls 124, thereby resulting in longitudinal orientation. As a result of the transverse stretching and longitudinal drawing, oriented film tube 128 is produced, this blown tubing preferably having been both stretched at a ratio of from about 1:1.5 to about 1:6, and drawn at a ratio of from about 1:1.5 to about 1:6. More preferably, the stretching and drawing are each performed at a ratio of from about 1:2 to about 1:4. The result is a biaxial orientation of from about 1:2.25 to about 1:36, more

preferably, from about 1:4 to about 116. While bubble 126 is maintained between pinch rolls 124 and 130, oriented film tube 128 is collapsed by rollers 132, and thereafter conveyed through pinch rolls 130 and across guide roll 134, and then rolled onto wirid-up roll 136. Idler roll 138 assures a good wind-up. This process can be carried out continuously in a single operation, or intermittently, e.g., as a two-stage process, in which the extruded, irradiated tape is wound up after irradiation, and, after a period of storage, unwound and subjected to heating and orienting in order to arrfive at oriented film tubing 128.

Detailed Description Text (127):
In another preferred embodiment, the multilayer film of the invention can be used as a bag or as a tubular casing, preferably a shirrable casing. Preferably, the casing is used for the packaging of food products, especially processed meat products and fresh red meat products. Among the types of meat which can be packaged in the films and packages according to the present invention are poultry, pork, beef, sausage, lamb, goat, horse, and fish. Preferably, the casing of the present invention is used in the packaging of pork, poultry, beef, and sausage products.

Field of Search Class/SubClass (12):
428/36.7